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ID:

University of Bahrain
CE -- CIT -- UOB

TEST 2 (16 May 2016) ITCE 444: μ P-Based Design

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Time: 75 minutes

Q1. [58 marks]

Program Timer0 to count the number of people entering a building. When the number reaches hundred (100), stop counting and display the letter F on a common cathode seven segment LED display connected to port D. Draw a simple schematic for this system.

Q2. [42 marks]

Assume an ideal (10 mV/ $^{\circ}$ C) linear temperature sensor is connected to one of the inputs of the μ C 10-bit ADC where $V_{REF} = 1.28$ volt:

- Which **pin** would you use for the input and which pin for the reference voltage.
- Suggest suitable values for the contents of registers ADCON0 and ADCON1?
- Find the temperature range covered.
- Find the temperature resolution.
- Find the temperature if the ADC reading is 0B7.
- What will be ADC reading at 35 $^{\circ}$ C?
- What V_{REF} value will make temperature resolution 0.1 $^{\circ}$ C per step? What will be the temperature range then?

TMR0ON	T08BIT	T0CS	T0SE	PSA	T0PS2	T0PS1	T0PS0
TMR0ON	D7	Timer0 ON and OFF control bit 1 = Enable (start) Timer0 0 = Stop Timer0					
T08BIT	D6	Timer0 8-bit/16-bit selector bit 1 = Timer0 is configured as an 8-bit timer/counter. 0 = Timer0 is configured as a 16-bit timer/counter.					
T0CS	D5	Timer0 clock source select bit 1 = External clock from RA4/T0CKI pin 0 = Internal clock (Fosc/4 from XTAL oscillator)					
T0SE	D4	Timer0 source edge select bit 1 = Increment on H-to-L transition on T0CKI pin 0 = Increment on L-to-H transition on T0CKI pin					
PSA	D3	Timer0 prescaler assignment bit 1 = Timer0 clock input bypasses prescaler. 0 = Timer0 clock input comes from prescaler output.					
T0PS2:T0PS0	D2D1D0	Timer0 prescaler selector					
	0 0 0	= 1:2 Prescale value (Fosc / 4 / 2)					
	0 0 1	= 1:4 Prescale value (Fosc / 4 / 4)					
	0 1 0	= 1:8 Prescale value (Fosc / 4 / 8)					
	0 1 1	= 1:16 Prescale value (Fosc / 4 / 16)					
	1 0 0	= 1:32 Prescale value (Fosc / 4 / 32)					
	1 0 1	= 1:64 Prescale value (Fosc / 4 / 64)					
	1 1 0	= 1:128 Prescale value (Fosc / 4 / 128)					
	1 1 1	= 1:256 Prescale value (Fosc / 4 / 256)					

ADCS1	ADCS0	CHS2	CHS1	CHS0	GO/DONE	--	ADON
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ADCS2 (from ADON1)	ADCS1	ADCS0	Conversion Clock Source
0	0	0	Fosc/2
0	0	1	Fosc/8
0	1	0	Fosc/32
0	1	1	Internal RC used for clock source
1	0	0	Fosc/4
1	0	1	Fosc/16
1	1	0	Fosc/64
1	1	1	Internal RC used for clock source

CHS2	CHS1	CHS0	CHANNEL SELECTION
0	0	0	CHAN0 (AN0)
0	0	1	CHAN1 (AN1)
0	1	0	CHAN2 (AN2)
0	1	1	CHAN3 (AN3)
1	0	0	CHAN4 (AN4)
1	0	1	CHAN5 (AN5) not implemented on 28-pin PIC18
1	1	0	CHAN6 (AN6) not implemented on 28-pin PIC18
1	1	1	CHAN7 (AN7) not implemented on 28-pin PIC18

GO/DONE A/D conversion status bit.

1 = A/D conversion is in progress. This is used as start conversion, which means after the conversion is complete, it will go LOW to indicate the end of conversion.

0 = A/D conversion is complete and digital data is available in registers ADRESH and ADRESL.

ADON A/D on bit

ADFM	ADCS2	--	--	PCFG3	PCFG2	PCFG1	PCFG0
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ADFM A/D Result format select bit

1 = Right justified: The 10-bit result is in the ADRESL register and the lower 2 bits of ADRESH. That means the 6 most significant bits of the ADRESH register are all 0s.

0 = Left justified: The 10-bit result is in the ADRESL register and the upper 2 bits of ADRESL. That means the 6 least significant bits of the ADRESL register are all 0s.

ADCS2 A/D Clock Select bit 2. This bit along with the ADCS1 and ADCS0 bits

PCFGs	AN7	AN6	AN5	AN4	AN3	AN2	AN1	AN0	Vref+	Vref-	C/R
0 0 0 0	A	A	A	A	A	A	A	A	Vdd	Vss	8/0
0 0 0 1	A	A	A	A	Vref+	A	A	A	AN3	Vss	7/1
0 0 1 0	D	D	D	A	A	A	A	A	Vdd	Vss	5/0
0 0 1 1	D	D	D	A	Vref+	A	A	A	AN3	Vss	4/1
0 1 0 0	D	D	D	D	A	D	A	A	Vdd	Vss	3/0
0 1 0 1	D	D	D	D	Vref+	D	A	A	AN3	Vss	2/1
0 1 1 x	D	D	D	D	D	D	D	D	-	-	0/0
1 0 0 0	A	A	A	A	Vref+	Vref-	A	A	AN3	AN2	6/2
1 0 0 1	D	D	A	A	A	A	A	A	Vdd	Vss	6/0
1 0 1 0	D	D	A	A	Vref+	A	A	A	AN3	Vss	5/1
1 0 1 1	D	D	A	A	Vref+	Vref-	A	A	AN3	AN2	4/2
1 1 0 0	D	D	D	A	Vref+	Vref-	A	A	AN3	AN2	3/2
1 1 0 1	D	D	D	D	Vref+	Vref-	A	A	AN3	AN2	2/2
1 1 1 0	D	D	D	D	D	D	D	A	Vdd	Vss	1/0
1 1 1 1	D	D	D	D	Vref+	Vref-	D	A	AN3	AN2	1 / 2

A = Analog input, D = Digital I/O

C/R = # of analog input channels / # of pins used for A/D voltage reference

The default is option 0000, which gives us 8 channels of analog input and uses the Vdd of PIC18 as Vref.